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PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventors: GORDON FRANK LEITNER and RICHARD WARREN GOELDNER



901077

Date of Application and filing Complete Specification July 15, 1960.

No. 24705/60.

Complete Specification Published July 11, 1962.

Index at acceptance:—Class 32, B(3D1:4A:5J).

International Classification:—B01d.

COMPLETE SPECIFICATION

Evaporator

PATENTS ACT, 1949

SPECIFICATION NO. 901,077

In accordance with the Decision of the Superintending Examiner, acting for the Comptroller-General, dated the 19th day of February, 1964, this Specification has been amended under Section 14 in the following manner:—

Page 1, line 52, Page 2, line 121, after "shell", insert "said longitudinal wall including insulating means for insulation between chambers on opposite sides of the shell",

also, Reference has been directed in pursuance of Section 9, subsection(1) of the Patents Act, 1949 to patent No. 855,550.

THE PATENT OFFICE,  
20th April, 1964

D 4444/1(2)/R.109 200 4/64 PL

30

**ERRATUM**

SPECIFICATION No. 901,077

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Page 2, line 83, after "fresh" read "sea"

THE PATENT OFFICE  
16th February 1965

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## COMPLETE SPECIFICATION

### Evaporator

5 We, AQUA-CHEM, INC., formerly known as  
Cleaver Brooks Special Products, Inc., a cor-  
poration organized under the laws of the State  
of Wisconsin, United States of America, of  
225, North Grand Avenue, Waukesha, Wis-  
consin, United States of America, do hereby  
declare the invention, for which we pray that  
a patent may be granted to us, and the method  
by which it is to be performed, to be particu-  
larly described in and by the following state-  
ment:—

This invention relates to an evaporator and  
more particularly to a multiple stage flash  
evaporator for water distillation.

15 It is the general object of the present inven-  
tion to produce a new and improved evapora-  
tor of the character described.

20 It is a more specific object of the invention  
to produce a flash evaporator of the multiple  
stage type which is so constructed and  
arranged to be efficient and compact and yet  
economical to manufacture.

25 A more specific object of the invention is  
to provide an evaporator of the character de-  
scribed in the preceding paragraphs wherein  
an elongated generally cylindrical casing may  
be divided into a plurality of flash chambers  
by means of a single longitudinal wall and a  
plurality of transverse partitions, thereby pro-  
30 viding an evaporator in which the heat losses  
can be reduced to the minimum, fabrication  
is simplified, and more efficient operation will  
result.

35 Yet a further object of the invention is to  
produce a flash evaporator of the type de-  
scribed in the preceding paragraph wherein  
said longitudinal wall is insulating in char-  
acter so as to permit the first and last stages  
of the evaporator to be at the same end of the  
40 elongated casing thereby furthering the econo-  
mies of manufacture.

According to the present invention there is  
provided a flash evaporator for water distilla-

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tion comprising an elongated shell, a plurality  
of transverse partitions dividing the shell into  
a plurality of transverse sections, a central,  
vertical, longitudinal wall extending substanti-  
ally from end to end of the shell and dividing  
the sections into a first series of flash cham-  
bers extending along one side of the  
shell and a second series of flash chambers  
extending along the other side of the shell,  
means in each chamber for condensing the  
flash vapors and for withdrawing conden-  
sate therefrom, and means for passing the  
water progressively through the first  
series of chambers and then through the  
second series of chambers, a feed water inlet  
opening into the first chamber of the first  
series of chambers and a feed water outlet  
opening into the last chamber of the second  
series of chambers, said first and last cham-  
bers being defined by a common partition and  
separated by said wall.

The invention will now be described with  
reference to the accompanying drawings, in  
which:—

Figure 1 is a top plan view of a distilling  
apparatus embodying the invention;

Figure 2 is an enlarged vertical section along  
the line 2—2 of Figure 1; and

Figure 3 is an enlarged vertical section  
taken along the line 3—3 of Figure 2.

Referring now to Figure 1 of the drawings,  
there is shown an evaporator apparatus in-  
cluding a generally cylindrical elongated shell  
10 divided by transverse partitions 11a, 11b,  
11c and 11n, into a plurality of transverse sec-  
tions defined between the partitions.

A central, vertical, generally longitudinally  
extending wall indicated generally as 12 di-  
vides each of the sections into flash chambers,  
there being a first series of flash chambers 13a,  
13b, 13c, 13d and 13n, extending along one  
side of the shell, and a second series of flash  
chambers 14a, 14b, 14c, 14d and 14n extend-

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ing along the other side of the shell. End walls 15 and 16 form closures for the end of the shell and are utilized in a manner hereinafter described for providing feed water flow connections.

5 As clearly shown in Figures 2 and 3, each of the partitions is provided with an opening 17 adjacent the bottom of the shell so as to establish communication between the flash chambers in each series of flash chambers, and means (described hereafter) are provided to maintain a liquid or loop seal between the chambers of each section. As seen in Figure 10 3, extending across the bottom of each flash chamber is a weir 18 having a height greater than the top of the adjacent opening 17. A perforated plate 19 extends horizontally across but spaced from the bottom of each flash chamber and connects at one end to the adjacent partition and at the other end to the top of the weir.

In each flash chamber there is provided a plurality of inverted channels 20 extending across the top of the chamber to prevent water splashing upwardly above the perforated plate 19 from reaching the demister 21. Vapors flashed in each flash chamber after passing through the demister are condensed on the condenser tube bundle 22 and fall into a condensate trough 23 from which they may be drawn through the distillate outlet 24.

In operation, as applied to sea water distillation, fresh salt water is passed by a pump (not shown) into a large conduit (not shown) from whence it passes into the condenser tubes in the flash chamber stage 14a, thence lineally through condenser tubes extending from end to end of the shell and sequentially through flash chambers 14b, 14c, 14d and eventually to chamber 14n. Leaving the condenser tubes in chamber 14n the sea water is passed by means of conduit 26 into the condenser tubes in the flash chamber 13n and then sequentially (and in the same manner as the passage through the 14 series) through the condenser tubes in the flash chambers 13d, 13c, 13b and 13a. The sea water, warmed by the passage through the condenser tubes in the chambers, is then directed by means of a pipe 27 into a feed water heater 28 from which it is discharged through pipe 29 into a feed water inlet 30 which is located beneath the perforated plate 19 in the first stage 13a of the first series of flash chambers. The hot feed water passes upwardly through the perforations in the plate 19 in the flash chamber 13a and a portion thereof flashes into vapor within the chamber, which vapor is condensed and withdrawn in the manner previously described. Unflashed sea water passes over the weir 18 downwardly through the opening 17 and emerges beneath the perforated plate 19 in the chamber 13b, the next lower chamber of the series. Unflashed sea water passing out of the chamber 13n is directed by suitable piping

(not shown) into the chamber 14n and then passes sequentially to the last chamber of the last series 14a. A suitable feed water outlet 31 directs the feed water into a discharge line 32 for discharge overboard.

Preferably, there are at least ten flash chambers in each series, thus making a total of at least twenty chambers, and as many as thirty or forty may be provided.

It will be noted that the first chamber in the first series, that is the chamber 13a, is separated from the last chamber in the last series, chamber 14a, by the longitudinal wall 12. It will be clear that the feed water from which the vapors are to be flashed is at its highest temperature in the chamber 13a and at its lowest temperature in the chamber 14a, while on the other hand the incoming fresh water directed into the condenser tubes is at its coolest temperature in the chamber 14a and at its highest temperature in the chamber 13a. To maintain the temperature differentials just stated which are required for the operation of the apparatus, the wall 12 is of insulating construction and thus acts to prevent or materially reduce the exchange of heat between chambers on opposite sides of the shell. In the particular embodiment chosen for illustration, the wall 12 is made up of two wall portions 12a and 12b which are separated by a space 12c. The space 12c may be provided with insulating material such as fiberglass if desired, although normally this is not necessary.

The economies of making an evaporator which is primarily a single elongated and, preferably, cylindrical shell divided into the required number of flash chambers by simple partitioning, will be readily apparent to those skilled in this particular art. Furthermore, the utilization of the lineal tubes in the condenser bundles which extend without a reverse and from end to end of each series of flash chambers also reduces the expense of manufacturing and increases the efficiency of operation.

#### WHAT WE CLAIM IS:—

1. A flash evaporator for water distillation comprising an elongated shell, a plurality of transverse partitions dividing the shell into a plurality of transverse sections, a central, vertical, longitudinal wall extending substantially from end to end of the shell and dividing the sections into a first series of flash chambers extending along one side of the shell and a second series of flash chambers extending along the other side of the shell, means in each chamber for condensing the flashed vapors and for withdrawing condensate therefrom, and means for passing the water progressively through the first series of chambers and then through the second series of chambers, a feed water inlet opening into the first chamber of the first series of chambers and a feed water outlet opening into the last chamber of the second series of chambers,

said first and last chambers being defined by a common partition and separated by said wall.

5 2. A flash evaporator according to Claim 1, wherein said wall comprises two wall portions which are spaced apart to provide substantial insulation between chambers on opposite sides of said shell.

10 3. A flash evaporator according to Claim 1, or 2, wherein there are sufficient partitions to form in said shell at least twenty chambers.

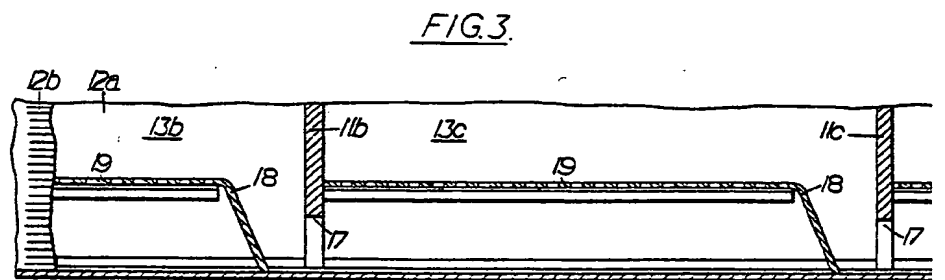
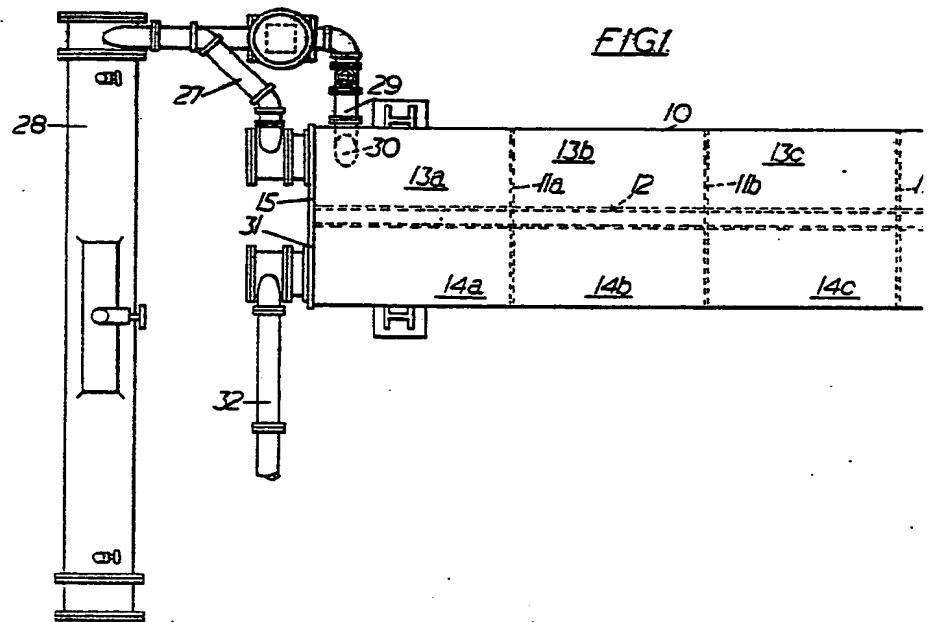
4. A flash evaporator according to Claim 1, 2 or 3, wherein each of said partitions is provided with two openings one adjacent the

bottom of each flash chamber, and each flash chamber is provided with a weir extending 15 above the said opening in the partition, each chamber in each series thereby being sealed from the next chamber in the series by said partition and by a feed water seal created 20 by said weir.

5. A flash evaporator for water distillation substantially as herein described with reference to the accompanying drawings.

STEVENSON, LANGNER, PARRY &  
ROLLINSON,

Chartered Patent Agents,  
Agents for the Applicants.



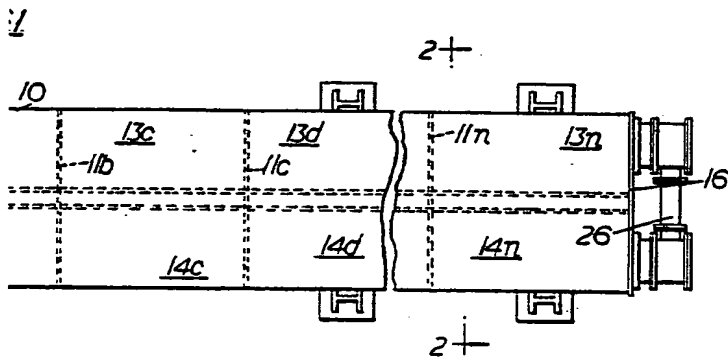
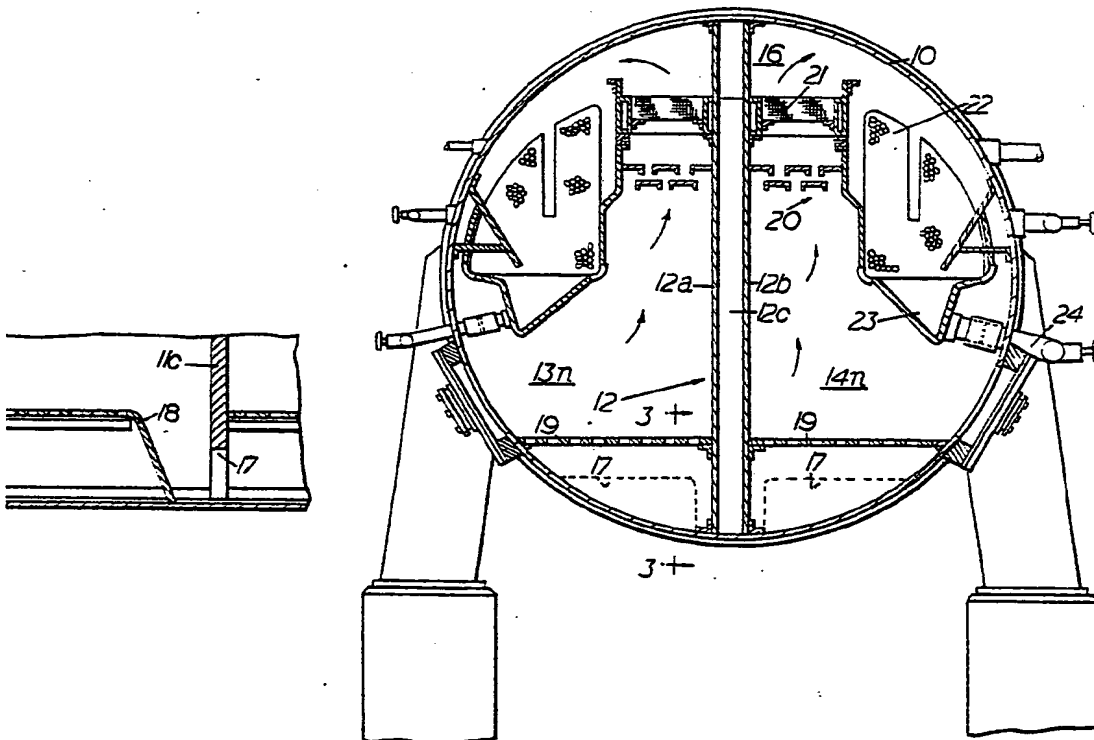
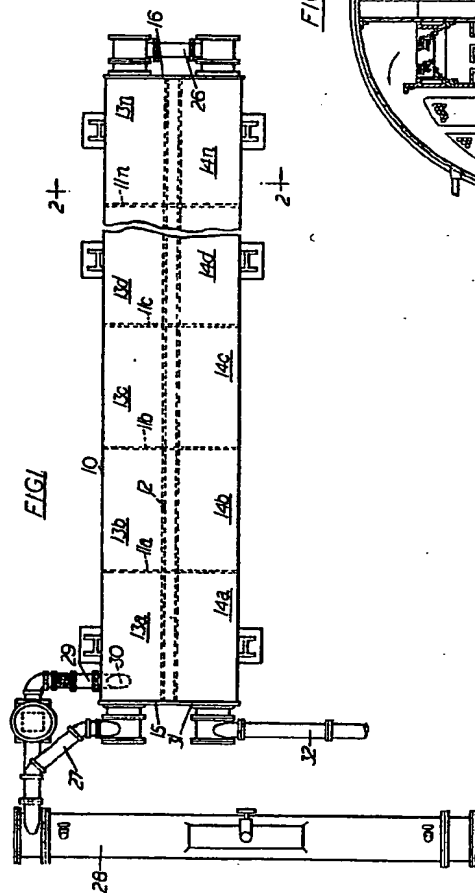
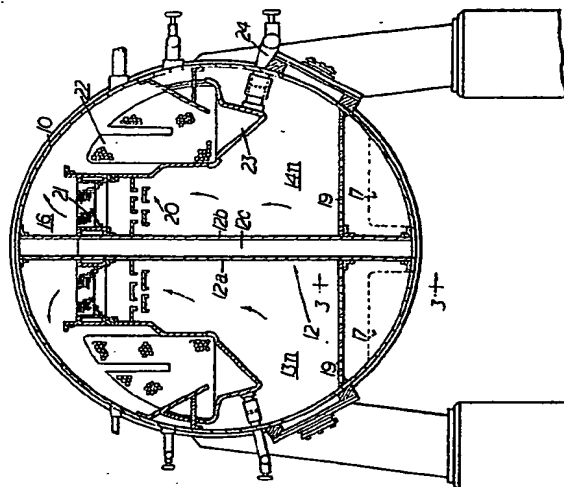


FIG. 2.





*FIG. 2*



*FIG. 3*

